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Renminbi Undervaluation, China's Surplus, and the US Trade Deficit

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INTRODUCTION

On June 21, 2010, in the run-up to the G-20 meeting in Toronto, China announced that it would shift to a more flexible exchange rate policy. From mid-June to July 30 the yuan rose 0.8 percent against the dollar. In contrast, the currency had remained fixed (at about 6.83 yuan to the dollar) from September 2008 to early June 2010. Pressure not only from the United States and the European Union but also from Russia, Brazil, and India as well as the IMF seems likely to have played a role in China's decision, although concerns about domestic inflation may also have been a factor.

An undervalued renminbi is widely considered to have contributed to large Chinese current account surpluses in recent years and, correspondingly, to large US current account deficits. China had previously moved in mid-2005 to allow its exchange rate to appreciate, and from June 2005 to August 2008 the currency rose by 18.6 percent in real effective (trade-weighted) terms (IMF 2010a). But then the intensification of the financial crisis in the United States prompted Chinese authorities to freeze the currency against the dollar once again, in pursuit of greater stability in the face of greater international uncertainty. Nonetheless, the safe-haven effect boosted the dollar and hence pushed up the renminbi still further, and when the dollar peaked in March 2009 the real effective exchange rate of the renminbi stood 25.8 percent above its June 2005 level. It is shown in this policy brief that this strong increase contributed importantly to the reduction of China's current account surplus from its peak of 11 percent of GDP in 2007 to less than 6 percent by 2009 (although the global recession also influenced the 2009 outcome).

The easing in the global financial crisis beginning in April 2009 and the subsequent unwinding of the safe-haven effect brought an easing of the dollar and hence the renminbi, and by year-end 2009 the real effective rate of the renminbi was back down to 17 percent above the June 2005 level. With even the 2009 current account excessive by most standards (Cline and Williamson 2010), the fixed rate against the dollar had once again placed China in the prospective position of aggravating rather than helping reduce global imbalances. The return to flexibility in June 2010 gives China the scope to contribute further to international adjustment of imbalances, but whether it does so will depend on whether the authorities allow the yuan to rise at a sustained pace that is comparable to or greater than that observed in the previous period of flexibility (June 2005 through August 2008).

Against the US dollar, during the period of flexibility the yuan rose by 21 percent from June 2005 to August 2008. Skeptics argue that because the US trade deficit with China did not decline during this period, appreciation of the yuan is not an effective remedy for China's surpluses or for US deficits. As just indicated, this note presents evidence showing instead that the strength of the renminbi does affect China's external balance. Moreover, it will be shown that the strength of the renminbi also affects the bilateral trade balance with the United States. So although for policy purposes it is the global balances for both the United States and China

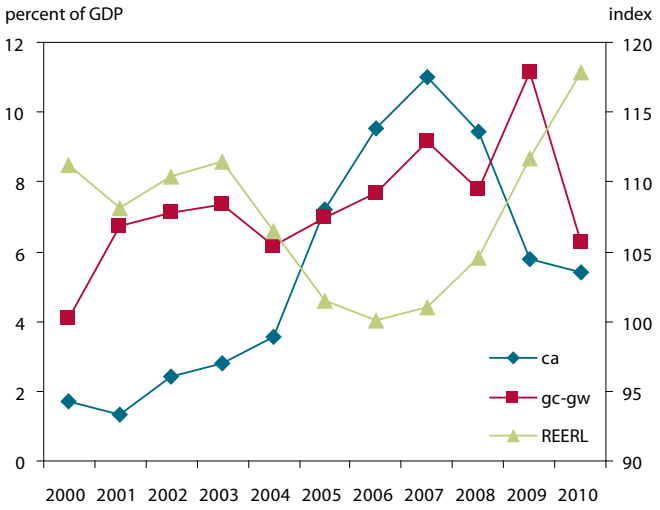
rather than their bilateral balance that should matter, both China's global balance and its bilateral balance against the United States are clearly influenced by the strength of the renminbi, both on an effective basis and bilaterally against the US dollar.

IMPACT OF THE RENMINBI ON CHINA'S EXTERNAL SURPLUS

Figure 1 shows the Chinese current account surplus as a percent of GDP (ca), the excess of China's GDP growth rate over the world growth rate (gc-gw), and (on the right-hand side) the IMF's index of the real effective exchange rate (REER), which has a base of 100 in 2005.[1] The exchange rate variable (REERL) is lagged, and equals the average of the level in the two previous years (so that, for example, the figure shows the index average for 2008–09 in the "2010" position). The lag reflects the time it takes for the exchange rate signal to be interpreted as more than a temporary fluctuation, and the additional time for resulting production decisions and trade flows to materialize. A relatively strong renminbi in 2001–02 (index at about 111) was associated with a moderate current account surplus of 2.8 percent of GDP by 2003. Then following a period of weakness in the renminbi as the currency "rode the dollar down" in 2002–05, by 2005–06 the index stood at an average of only 101, contributing to a surge of the surplus to a peak of 11 percent of GDP in 2007. The subsequent decline of the surplus to 5.8 percent of GDP in 2009 and a similar level in 2010 coincides with the lag to a new phase of a stronger renminbi (from the appreciation against the dollar in 2005–08 plus "riding the dollar up" as the safe-haven effect boosted the dollar from 2008 to 2009).[2]

Rapid growth in China boosts domestic demand, and growth performance in the rest of the world affects export demand, so China's external balance has also responded to the difference between domestic and foreign growth. As shown in the figure, this difference peaked in 2009 when China achieved growth of 9.1 percent but worldwide growth fell to –2 percent in the "Great Recession."

Figure 1 China's current account surplus, growth rate relative to world growth, and lagged real effective exchange rate (right scale)



Source: See text.

A statistical test confirms that China's current account surplus responds to the real exchange rate and the growth differential. Using the same data as shown in figure 1, the following relationship can be estimated:

$$(1)\quad ca = \underset{(5.9)}{46.7} - \underset{(-6.1)}{0.416}\, REERL - \underset{(-0.6)}{0.155}\,(gc - gw) + \underset{(5.6)}{0.785}\, T;$$

adj. $R^2 = 0.89$

where *ca* is the current account surplus as a percent of GDP, *REERL* is the lagged real effective exchange rate, *gc* is China's growth rate, *gw* is world growth, *T* is a time trend variable (=1 for 2000 through 11 for 2010), and t-statistics are in parentheses. The coefficients for the exchange rate and the time trend are highly significant in statistical terms. The coefficient on the real effective exchange rate indicates that a 1 percent rise in the renminbi yields a 0.45 percent of GDP fall in the current account, or by $25 billion at China's 2010 economic scale.[3] This impact is larger than the corresponding estimate of 0.30 (presently corresponding to $17 billion) used for China in the multilateral equilibrium exchange rate model of Cline (2008).

The implied export price elasticity in this result is relatively high. As argued in Cline (2005 and 2008), current account changes relative to GDP as a consequence of currency adjust-

1. Data are from IMF (2010a and 2010b) except as noted below.

2. For 2010, the current account estimate at 5.3 percent of GDP is the average of the IMF (2010b), World Bank Beijing (2010), and private sector forecasts (Blue Chip 2010). China's GDP in dollars is calculated at $4.909 trillion for 2009 (IMF 2010a) and $5.64 trillion for 2010. The latter estimate is based on 9.5 percent real growth, consumer price index (CPI) inflation of 3.7 percent (both from World Bank Beijing 2010), a corresponding estimate of 4 percent increase in the GDP deflator (which rose faster than the CPI in 2003–08; IMF 2010a), and an average exchange rate of 6.78 yuan per dollar. Note that estimated growth in 2009 was revised upward by the Chinese government in mid-2010, from 8.7 percent to 9.1 percent.

3. The average exchange rate index for the sample period is 107.7, so an increase of 1 percent is a rise of 1.077 units of *REERL*, and 1.077 x (–0.416) = – 0.45.

ment tend to be driven by export changes, because volume changes in imports tend to be neutralized by changes in the domestic currency value of the foreign currency.[4] With exports of goods and services at about 35 percent of GDP in 2006–08 (IMF 2010a), the coefficient of –0.45 percent of GDP change in current account for a 1 percent real effective appreciation implies an export price elasticity of –1.29 (= –0.45/0.35), higher than the elasticity of unity used in estimating the current account impact parameter for China in Cline (2008).

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A recent empirical study at the US Federal Reserve finds even higher price elasticities for China's exports.[5]

The coefficient on domestic growth minus foreign growth has the correct sign but is not statistically significant. It indicates that an increase of one percentage point in the growth differential reduces the surplus by 0.155 percent of GDP. If instead the income elasticity were unity for both imports and exports, then considering the share of trade in GDP this coefficient would be expected to be –0.33 instead of –0.155, so the coefficient is probably understated.[6]

The coefficient on the time trend means that there is a strong upward drift in China's current account surplus over time, at a pace of about 0.8 percentage point of GDP per year. Taken together, the exchange rate and time-trend coefficients imply that it would require an effective appreciation at a pace of 1.7 percent per year to keep the current account surplus from rising relative to GDP.[7] This finding is consistent with the observation of Goldstein and Lardy (2009, pp. 10, 24) that there is a differential productivity growth rate of about 3 percent per year between China and its trading partners, and the diagnosis by Mussa (2008, p. 285) that "the long-run equilibrium path for China's real exchange rate has a moderate upward tilt of about 2 percent per year." The broader tradition underlying such a view is the Balassa-Samuelson effect whereby there is a secular rise in the real effective exchange rate of a rapidly growing developing economy as a consequence of more rapid productivity growth in its tradable goods sector than in its non-traded sector.

The evidence here supports the view that the real effective exchange rate influences the current account balance in the expected way. Special stories about how the textbook relationship does not apply to China (for example, because reliance of Chinese exports on imported inputs nullifies exchange rate effects, or because multinationals ignore exchange rates in sourcing decisions) are rejected by the results here (and in other recent studies such as Ahmed 2009).

IMPACT OF THE RENMINBI ON THE US EXTERNAL DEFICIT

What about the influence on the US external accounts? The most straightforward way to calculate the impact of renminbi appreciation on the US external deficit is to consider the weight of China in US trade, calculate the decline in the US trade-weighted REER when the renminbi rises, and apply the usual relationship between the US REER and the US current account balance. Cline (2008) identifies a parameter of –0.16 for the change in the US current account balance as a percent of GDP for each percent increase in the US REER. China has a weight of 9.1 percent in the US REER (p. 24).[8] So a 10 percent appreciation of the renminbi causes a 0.91 percent depreciation of the US REER. That depreciation in turn causes a 0.91 x 0.16 = 0.14 percent of GDP improvement in the US current account balance, or a reduction by about $22 billion in the US current account deficit when applied to present GDP. As discussed below, the effect is greater if other regional economies follow China and appreciate their currencies against the dollar as well.

An alternative, indirect way to calculate the impact on US external accounts is to consider the expected share of the United States in the counterpart of the change in China's

4. If the price elasticity of imports is unity, appreciation of the exchange rate causes an increase in the quantity of imports demanded that is exactly offset, in local currency values, by the decline in local currency paid for each unit of foreign currency.

5. Ahmed (2009) finds an export price elasticity of –1.9 for non-processing exports and –1.5 even for exports of good processed using imported inputs (p. 23). The study's simulation exercise finds that if the real effective exchange rate had risen cumulatively by 18 percent above its actual path from 2005:3 to 2009:2, real exports by mid-2009 would have been 30 percent lower (p. 30), implying an overall effective price elasticity for exports of –1.67.

6. In 2008, exports of goods and services stood at 36.6 percent of GDP, and imports of goods and services at 28.4 percent (IMF 2010a). With an income elasticity of unity on both sides, a reduction in foreign growth by 0.5 percent and increase in domestic growth by 0.5 percent would reduce exports by 0.183 percent of GDP and raise imports by 0.142 percent of GDP, for a total reduction in the trade surplus by 0.325 percent of GDP.

7. That is: 0.785/0.45 = 1.74.

8. This share is the ratio of bilateral exports plus imports to total US exports plus imports for 2006.

external balance as a consequence of appreciation of the renminbi. The United States represents about 15 percent of China's trade (Cline, 2008, p. 25). If the estimate of equation 1 is applied as the basis for calculating China's change in current account, a 10 percent real effective appreciation of the renminbi causes a 4.5 percent of (China's) GDP reduction in the current account surplus. Against the 2010 GDP of $5.6 trillion, the result is an increase in the US trade balance by $38 billion (= 4.5 percent x $5.6 trillion x 0.15), out of a total $250 billion adjustment for China. This indirect calculation is higher than the direct one primarily because the impact

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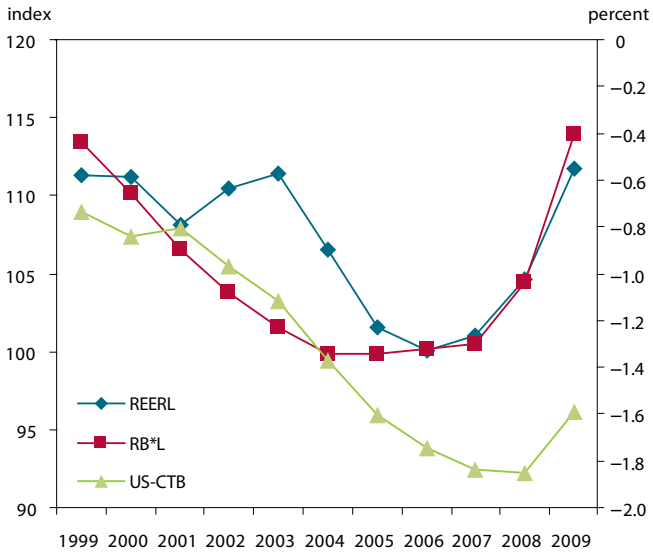
estimate in equation 1 here is larger than the corresponding estimate in the model in Cline (2008).

Skeptics would argue that the evidence does not support such model calculations because the bilateral US-China imbalance did not improve from 2005 to 2008 despite the rise in the renminbi. It is indeed correct that the bilateral imbalance widened instead of narrowing in this period, from a deficit of $203 billion in 2005 to $268 billion in 2008 (BEA 2010). However, this interpretation would ignore two important considerations: the time lag for the exchange rate signal to affect the outcome, and any adverse time trend in the bilateral balance that could have been expected in the absence of any exchange rate change.

Figure 2 shows the path of the US bilateral trade balance with China, as a percent of US GDP, against the lagged real effective exchange rate of the renminbi (multilateral), designated REERL.[9] Once again the lagged rate is the average of the previous two years for the real effective exchange rate. In addition, the figure shows the corresponding lagged real exchange rate of the renminbi against the US dollar (RB*L), deflating by consumer prices on both sides. The strong decline in the real bilateral renminbi against the dollar from 1999 in the figure (average of 1997–98) to 2004 (average of 2002–03) despite a constant nominal exchange rate of 8.28 yuan per

Figure 2 US-China bilateral trade balance as percent of US GDP and lagged real effective exchange rate of the renminbi



Source: IMF 2010a, BEA 2010, and author's calculations.

dollar in this period was the result of low inflation in China (yearly average of 0.27 percent) and moderate inflation in the United States (2.3 percent). Once again the pattern is strongly suggestive of a fairly close (this time positive) relationship between the bilateral balance and the real exchange rate of the renminbi, whether multilateral or bilateral, but with a relatively strong downward time trend.

Once again regression tests confirm the presence of a relationship for the real exchange rate. First, using the multilateral real effective exchange rate lagged:

$$(2)\quad B = \underset{(-8.2)}{-4.55} + \underset{(6.9)}{0.0343}\ REERL + \underset{(2.4)}{0.0446}\ GDIF \underset{(-8.9)}{-0.129}\ T;$$

adj. $R^2 = 0.986$

where B is the US bilateral balance with China as a percent of US GDP, *REERL* as before is China's lagged real effective (multilateral) exchange rate index (average of previous two years), *GDIF* is China's growth rate minus the US growth rate, and T is the time trend. There is an extremely high degree of explanation, and all of the coefficients are statistically significant and have the correct signs. The coefficient of China's (lagged) real effective exchange rate on the bilateral US trade balance with China indicates that a 10 percent real effective appreciation of the renminbi is found to cause a reduction in the bilateral US deficit by 0.37 percent of US GDP, or $54 billion at 2010

9. US-China trade data are from BEA (2010).

levels.[10] The coefficient on the growth differential indicates that an increase of 1 percentage point in the excess of China's growth rate over that of the United States increases the US bilateral trade balance with China by 0.045 percent of GDP, or $6.6 billion.

Using the bilateral lagged real exchange rate instead, the best result is in the form of change from previous year. This test yields:

(3) $dB = -0.127 + 0.0282\ dRB^*L \text{ percent} + 0.0452\ dGDIF$;
(–3.7) (3.5) (2.1)

adj. $R^2 = 0.62$

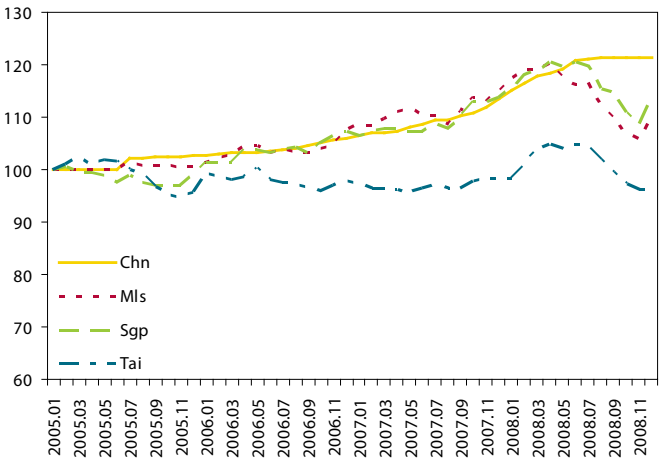
where *dB* is the change from the previous year in the bilateral balance as a percent of US GDP, *dRB*L* percent is the percentage change in the lagged bilateral real exchange rate, and *dGDIF* is the change from the previous year in the growth differential variable. This time the estimated coefficient shows that a 10 percent change in the lagged bilateral real exchange rate causes a change in the bilateral trade balance of 0.282 percent of GDP, or $41 billion. A change of 1 percentage point in the growth differential once again improves the US bilateral balance by 0.0452 percent of GDP, or $6.6 billion.

The tests in equations 2 and 3 thus find a stronger impact of renminbi appreciation on the US bilateral balance with China than is found for the overall US balance either using the US REER impact parameter from Cline (2008) or using the US share in the impact for China indicated by equation 1. The range of the four estimates, for a 10 percent appreciation of the renminbi, is from $22 billion (US REER basis) to $38 billion (equation 1 basis), $54 billion (equation 2 basis), or $41 billion (equation 3). The proper treatment of exchange rate lags as well as the time trend is important in identifying these effects in equations 1–3) here.

The adverse time trend in equation 2, and the adverse time trend indicated by the constant term in equation 3, are also broadly consistent with the results in equation 1, but larger than might be expected. Thus, the time trend of about 0.8 percent of GDP per year for China's rising current account surplus (equation 1), combined with a 0.15 share of the United States in China's trade, would predict an adverse bilateral trend for the United States that amounts to 0.785 x 0.15 x (5.6/14.8) = 0.045 percent of GDP, or $6.6 billion per year. In comparison, the bilateral test in equation 2 indicates an adverse time trend of 0.129 percent of GDP, or $19 billion.

10. Again because the average of the exchange rate index in the period 1998–2007 is 107.7, the magnitude of the regression coefficient needs to be increased by the factor 1.077 to arrive at the impact corresponding to a 1 percent rise in the real effective exchange rate (1.077 x 0.0343 = 0.037).

Figure 3 Currency strength against the US dollar in 2005–08: China, Malaysia, Singapore, and Taiwan (January 2005 = 100)



Source: Calculated from IMF 2010a.

Because equation 3 is in the form of changes from the previous year, the corresponding time trend coefficient is the constant, almost identical at –0.127. Because the bilateral tests yield about three times as large an adverse time trend as obtained when applying the US trade share to China's corresponding multilateral time trend, the question arises whether there is some reason that a general Balassa-Samuelson effect for China might be expected to be disproportionately focused on trade with the United States.

SATELLITE CURRENCIES

The effect on the overall (multilateral) US trade balance could be larger if some "satellite" currencies of economies that are close regional trading partners of China were to move along with the adjustment in the renminbi. Figure 3 suggests that this effect of induced movement in regional currencies has in fact been present. From mid-2005 to mid-2008, Malaysia and Singapore moved their exchange rates against the dollar by virtually the same proportion as China. For its part, Taiwan appreciated only about one-fourth as much (about 5 percent instead of about 20 percent). In contrast, another key regional partner of China's—Hong Kong special administrative region (SAR)—did not change its exchange rate against the dollar at all, because it has followed a dollar-based currency board regime.

The increment to the US trade balance from induced appreciation of these satellite currencies can be calculated in two alternative ways: from the standpoint of the effect on the US REER, and from the standpoint of the US share in the trade

impact of the change in the other countries' REERs. Malaysia, Singapore, and Taiwan have weights in US trade of 1.5 percent, 1.8 percent, and 2.2 percent, respectively. Appreciations of 10 percent, 10 percent, and 2.5 percent respectively by these three currencies would translate to an effective depreciation of 0.385 percent for the US dollar. Applying the US current account impact parameter, the result would be a reduction in the US external deficit by 0.062 percent of GDP, or by $9 billion.

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For the approach based on the US share in the impacts on other countries, the increment for the US would amount to $0.8 billion from Singapore, $1.1 billion from Malaysia, and nothing from Taiwan.[11] So incorporation of the satellite currency effect would boost the estimated US effect by a range of about $2 billion to $9 billion.

Nonetheless, it will remain to be seen whether a significant rise in the renminbi following the recent return to more flexibility, if such a rise does occur, will be followed by comparable increases in the currencies of Malaysia, Singapore, and even a partial rise for Taiwan. As can be seen in figure 3, when the global financial crisis entered a severe phase in the third quarter of 2008, these regional partners decoupled from the renminbi and allowed their currencies to depreciate substantially. So magnification of renminbi effects through lock-step parallel currency movements by regional partners cannot be taken for granted.

CONCLUSION

In sum, a simple statistical test provides empirical support to the view that China's exchange rate does matter importantly for China's current account balance. Other tests show that the strength of the renminbi also matters for the bilateral trade balance between the United States and China. For China, a rise of 1 percent in the real effective exchange rate causes a reduction in the current account surplus by 0.30 percent of GDP (Cline 2008) to 0.45 percent of GDP (equation 1). At 2010 scale, a 10 percent real effective appreciation would reduce China's current account surplus by about $170 billion to $250 billion. For the United States, the corresponding improvement in the current account balance would range from a low estimate of $22 billion (US REER basis without satellite currency effects) to a high of $63 billion (equation 2 bilateral basis plus high end of the range of satellite currency effects).[12] Decisions on China's exchange rate policy thus do matter for the objective of reducing international imbalances, rather than being irrelevant because of supposed structural peculiarities that cause the exchange rate to have no impact on either China's global trade or its bilateral trade with the United States.

At the same time, the positive time trend for China's current account surplus and negative trend for the US bilateral balance (coefficients on the time variable *T* in equations 1 and 2, and constant term in equation 3) suggest that adjustment accomplished by exchange rate correction alone will tend, over time, to be gradually reversed unless there is a sequence of successive appreciations of the renminbi. Other factors, and in particular special Chinese efforts to shift the economy away from external demand and toward domestic demand, are by implication important complements of exchange rate adjustment. In the absence of such efforts, the long-term trend toward a rising trade surplus would tend to cause growing excess demand and rising inflationary pressures on the economy.

11. Based on the current account impact parameters for Malaysia, Singapore, and Taiwan, combined with the US share in their trade (see Cline 2008). The calculation is: $\Delta TB_{US} = -\sum \Delta R_i \gamma_i Y_i \phi_i$ where ΔTB_{US} is the change in the US trade balance, ΔR is the proportionate change in the real effective exchange rate, γ is the current account impact parameter, Y is GDP, ϕ is the US trade share, and subscript *i* refers to the country in question. If China, Singapore, and Malaysia all appreciate 10 percent against the dollar and Taiwan appreciates by 2.5 percent, the result is an effective appreciation of 7.6 percent for Singapore and 6.9 percent for Malaysia (considerably less than 10 percent because of their large trade shares with each other, especially Malaysia and Singapore). For Taiwan the result is an effective depreciation of 0.6 percent, because the appreciation of its largest trading partner China outweighs its small depreciation against the dollar. (Note also that with these appreciations by these three trading partners, the 10 percent appreciation of the renminbi against the dollar would translate to a modestly smaller effective appreciation of 9.4 percent for China.)

12. Equation 3 confirms a significant exchange rate effect on the bilateral balance when using the bilateral real renminbi-dollar rate rather than China's real effective exchange rate, with the high estimate including satellite currency effects at $50 billion for a 10 percent rise in the renminbi.

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